REMARKS/ARGUMENTS

Claims 3, 4, 11 and 17 have been amended. Claims 3, 4, 11-14, 16 and 17 remain pending in this application.

Objections Under 35 USC § 132(a)

The Amendment filed April 10, 2007 stands objected to under USC 35 132(a) as allegedly introducing new matter into the disclosure.

The Examiner stated that the Amendment to paragraph 17 on page 12 of the Specification was considered as new matter because it stated "the mist separating apparatus has a direct piping connection 62...and a direct piping connecting... storage tank". The Examiner stated that in Fig. 1 only a cyclone type mist separating is shown and not a generic separating apparatus.

By this Amendment, Applicants' have further amended the portion beginning on line 17 on page 12 of the Specification by amending the last sentence thereof to read "As shown in FIG. 1, the cyclone type mist separating apparatus has a piping connection 62 extending from the lower liquid waste outlet to the storage tank and a piping connection 64 extending from the upper liquid waste outlet to the storage tank". It is submitted that this amendment to the paragraph 17 beginning on page 12 now does not recite new matter.

The Examiner further stated that "if the word 'direct' is intended to exclude any extra features in these piping connections, there are no sufficient support for 'negative limitation', the mere absence of a positive recitation is not basis for an exclusion, Ex Parte Grassellei...".

As noted above, the paragraph on line 17 on page 12 has now been amended to delete reference to "a direct piping connection" and now clearly states that the cyclone type mist separating apparatus has a piping connection extending from the lower liquid waste outlet to the storage tank and a direct piping connection 64 extending from the upper liquid waste outlet to the storage tank. Clearly this language is supported by Fig. 1 showing the piping connection 62 extending from the lower liquid waste outlet to the storage tank and the piping connection 64 extending from the upper liquid waste outlet to the storage tank.

As now set forth in the Specification, the language used very specifically describes Applicants' invention as shown in Fig. 1 and is not a "negative limitation".

In any event, reliance on Ex Parte Grasseli does not support the Examiner's position since the claim in Grasseli recited "...said catalyst being free from uranium, in the combination of vanadium and phosphorous". The court in Grasseli determined that "the negative limitation recited in a present claims, which did not appear in the Specification as filed, introduced new concepts and violate the description requirement of the first paragraph of 35 USC § 112".

Thus, the situation described in Grasseli is not applicable to the present situation wherein piping connections extending from lower liquid waste and the upper liquid waste outlet directly to the storage tank are clearly shown in Fig. 1 and are adequately described in the Specification.

Rejection Under 35 USC § 112

Claims 3-4, 11-14 and 16-17 stand rejected under 35 USC 112, first paragraph, as failing to comply with the written description requirement since they do not contain support for the limitation of a filter type mist separator. Independent claims 3, 4, 11 and 17 have now been amended to remove reference to a filter type mist separator. As previously noted, independent claim 13 does not refer to a filter type mist separator.

The Examiner also requested Applicants to point out support in the Specification for the limitation of "decomposing a toxic component containing at least one of SO_3, HF, NO, NO_2... produced by said decomposition of PFC... at the rear stage of PFC decomposition process".

As shown in Fig. 1 and as described in the Specification at page 11, line 12 to page 12, line 10, the PFC decomposition tower 1 has the PFC decomposition catalyst 8 on the upstream side of the exhaust gas flow and the hazardous component removing catalyst 9 on the downstream side of the exhaust gas flow below the catalyst 8. This clearly indicates that PFC is decomposed at the PFC decomposition catalyst 9 into hazardous substances such SO_3, HF, NO, NO_2, CO, SO_2, F_2, and then such substances are decomposed at the hazardous component removing catalyst 9. Therefore the two-step decomposition in the present invention is clearly supported by the Specification.

On page 5 of the Action, the Examiner states that there "is no disclosure in the instant specification to indicate that the 'decomposition products' from decomposing PFC and the 'hazardous component' are the same, i.e. there is no

disclosure to show that CO and SO_2, F_2 are obtained after decomposing a PFC gas that contains at least one of SF_6 and NF_3.

Applicants refer the Examiner to page 12, lines 3-8 of the Specification wherein it is stated that "In accordance with the present embodiment, assuming that the PFC is SF_6, or a gas containing SF_6, PFC decomposition catalyst 8 and the hazardous component removing catalyst 9 are packed into the PFC decomposition tower 1. The hazardous component here means CO, SO_2, F_2, and the like".

On page 5 of the Action, the Examiner further states that there is no support for direct piping connections as required in the instant claims and that there is no support for piping connections for the filter type mist separator. The application has been amended to recite in the paragraph beginning at line 17 on page 12 that only the cyclone type mist separating apparatus has a piping connection 62 extending from the lower liquid waste outlet to the storage tank and a piping connection 64 extending from the upper liquid waste outlet to the storage tank. The word "direct" has been deleted. Moreover, the independent claims have been amended to delete reference to the filter type mist separator and the word "direct". Thus, the claims have further been amended to define "separate piping connections extending from said lower liquid waste outlet and said upper liquid waste outlet, respectively, to a storage tank". Thus, it is submitted there is now support for the piping connections as now claimed.

Rejection of Claims Under 35 USC § 103

Claims 3-4, 11-14 and 16-17 stand rejected under 35 103(a) as being unpatenable over EP 0885648 in view of JP 11-216455 and Lang et al. USP 6,235,256.

Claims 3-4, 11-14 and 16-17 also stand rejected under 35 USC 103(a) as being unpatentable over Kanno et al. PG Pub. U.S. 2001/0001652 in view of either JP 11-216455 and Lang et al. USP 6,235,256.

In making this latter rejection the Examiner states that Kanno '652 is a U.S. counterpart of EP '648. The Examiners attention is directed to the fact that Kanno '652 claims priority of JP 10-19265 and JP 11-70322 whereas EP '648 only claims priority of JP 11-70322. In this regard it is noted that JP 11-70322 includes Fig. 10 and Fig. 9 in EP '648 appears in the place of Fig. 10 in JP 11-70322. It is noted that Fig. 9 differs considerably from Fig. 10.

Patentability of the Claims

As previously noted, the claims have been amended to delete any reference to the filter type mist separator. The claims have also been amended to delete "direct" and to further define a step of draining the liquids discharged from the lower liquid waste outlet and the upper liquid waste outlet of the cyclone type mist separating device through separate piping connections extending from the lower liquid waste outlet and the upper liquid waste outlet, respectively, to a storage tank. These amendments further define over the prior art, rendering the claims patentable.

None of the four references relied upon by the Examiner, i.e., EP 0885648, JP 11-216455, Lang et al. '6,235,256 or the Kanno et al. publication disclose the step of draining each of the liquid discharged from the lower liquid waste outlet and the liquid discharge from the upper liquid waste outlet through separate piping connections extending from the lower liquid waste outlet and the upper liquid waste outlet, respectively, to a storage tank.

On page 11 of the Action, the Examiner states that "JP '455 fairly teaches that the mists or moisture removed by the cyclone, i.e., a mist separating apparatus, can be recycled back to the scrubber and it would have been well within the skill of the artisan to provide a storage tank to serve as a buffer tank in order to regulate the amount and/or rate of the recovered moisture back to the scrubber".

This is not a teaching of the step limitation disclosed in the last paragraph of the independent claims. JP'455 does not disclose any storage tank and Applicants are not all concerned with recycling mist or moisture removed by a cyclone back to a scrubber. Therefore, for this reason alone, Applicants' method claims distinguish over the combinations of prior art cited by the Examiner.

There are other distinctions as well between the references cited by the Examiner and Applicants' invention as discussed in greater detail hereafter.

The present invention relates to a decomposition treatment of PFC gases particularly at least one of SF_6 and NF_3. Since the decomposition treatment of SF_6 and NF_3 produces decomposition products such as HF_1, SO_x (mainly SO_3), and NO_x (mainly NO, NO_1), the exhaust of decomposition is emitted into the atmosphere after

washing treatment in a washing tower in which such decomposition products are absorbed in water or alkaline aqueous solution.

As the present specification describes the inventors have found a new problem that the washing with water or alkaline aqueous solution causes a part of HF, SO_3, and NO in the decomposition product to form a mist accompanied with H_2O, and such mist clears the washing tower. For example, approximately 250-mol of H_2O accompanies 1-mol of SO_3 to form a mist, which is exhausted into the exhaust line in the decomposition system. This new problem has led the inventors to the present invention.

More specifically, newly found problems are that the SO_3 condenses when the temperature of the exhaust gas goes below its dew point and adheres on the inner wall of the exhaust pipe to cause choking thereof, that the SO_3 condensation also occurs on the exhaust blower and adheres inside thereof to make the blower malfunction, that NO generated from the decomposition treatment of NF_3 produces nitric acid mist, which flows into the exhaust line to corrode parts such as the exhaust pipe, and that HF generated form the decomposition treatment of carbon-based PFC gas also corrodes the exhaust pipe or blower. It is clearly stated in the present specification that that the present invention has resulted from finding a solution to these newly found problems.

The emission of a part of HF, SO_3, and NO in the decomposition product into the atmosphere should be eliminated as much as possible because it adversely affects the environment.

In the present invention, as Fig. 1 of the specification shows, a mist-containing gas is fed from the gas washing tower 13 to the cyclone type mist separating apparatus 21, where the mist is removed. Then the gas with the mist removed is emitted from the upper side of the cyclone type mist separating apparatus 21, while waste water is discharged from the cyclone type mist separating apparatus 21 into a storage tank 18 through piping connections 62 and 64 thereto provided at the bottom of and on the side of the cyclone type mist separating apparatus 21. The cyclone type mist separator shown in Fig. 2 of the present invention has piping connections to the storage tank 18. One piping connection is provided at the liquid outlet 24 at the lower portion of the cyclone separator and the other piping connection is provided at the liquid outlet 25 in the side portion thereof. Thus, the two piping connections both connect the cyclone separator with the storage tank.

As stated above, the waste water is discharged into the storage tank 18 through the piping connections thereto provided at the bottom of and on the side of the mist separating apparatus 21. Because the separated mist contains a corrosive component in a concentrated form, the waste water is discharged as the waste water 20 without being returned to the gas washing tower 13. Thus, the corrosive component included in the gas exhaust from the gas washing tower 13 will not increase and the corrosion of the mist separating apparatus 21 suppressed.

EP 08 85648 describes a decomposition treatment of a fluorine compound gas such as SF_6 and NF_3 using a specific catalyst produces HF, SO_x (mainly SO_3) and NO_x (mainly NO and NO_2). This reference, however, does not mention at all such aspects not only that the gas, which includes decomposition products

generated from the decomposition treatment of NF_3 or SF_6 is washed with water or alkaline aqueous solution, but also that such washing causes a part of the HF, SO_3, and No included in said decomposition product to form a mist accompanied with H_2O, and that such mist is emitted into the atmosphere clearing the washing tower. Further, there is no description at all about the removal of HF, SO_3 and NO before exhausting into the atmosphere.

The present invention is made based on a new problem found in the washing of the gas including decomposition products with water or alkaline aqueous solution.

EP '648 describes or suggests no mist separating apparatuses which remove mists from exhaust gas emitted from a gas washing tank. EP '648 does not teach or suggest discharging of liquid separated by a cyclone type mist separating apparatus to a storage tank.

Lang describes a process of water washing for acidic gasses such as SO_2, HCl, and H_2S in the scrubbing tower 1 having the first stage 3 and the second stage 4 to remove acidic gas component.

Lang '256, does not mention at all such aspects that NF_3 or SF_6 is decomposition-treated, that the washing of the gas, which includes decomposition products generated from the decomposition treatment, with water or alkaline aqueous solution causes a part of HF, SO_3 and NO included in the decomposition product to form a mist accompanied with H_2O, and that such a mist is emitted into the atmosphere after clearing the washing tower. Further, there is no description at all about the removal of HF, SO_3, and NO before exhausting into the atmosphere.

As stated above, a part of HF, SO_3, or NO in the decomposition product clears the washing tower in a form of mist accompanied with H_2O. The SO_3 condenses and adheres on the inner wall of the exhaust pipe to cause choking thereof and adheres inside the exhaust blower to make the blower malfunction. The NO corrodes the exhaust pipe etc, and HF also corrodes the exhaust pipe or the exhaust blower. Further, as stated, it is evident that the emission of a part of HF, SO_3, and NO in the decomposition product into the atmosphere should be eliminated as much as possible because they adversely affect the environment. However, Lang neither describes nor suggests these points.

What Lang describes is that accompanied mist is removed by colliding an acidic exhaust gas 17 against walls 10 and 10' and that any remaining acidic component is removed by spraying H_2O onto demister stage 4. These steps correspond to the steps up to the exhaust gas washing tower in the present invention. It is evident in Lang that mist that includes the acidulous exhaust 17 flows as it is from the duct into the exhaust gas flow 17" at the last stage as shown in Fig. 1. Thus in Lang there is neither a description nor any suggestion of collection of the mist itself in order to remove SO_x and NO_x.

The Examiner states that the present invention and Lang '256 have a point in common with each other. The demister stage 4 in Lang is an apparatus that sprays H_2O. This apparatus, however, corresponds to the gas washing tower 13 in the present invention. Lang neither describes nor suggests any mist separating apparatuses that the present invention defines.

This means that Lang does not include any technique for the discharging of the mist separated by a mist separating apparatus to a storage tank. Therefore, the exhaust gas emitted from the scrubbing tower includes much mist. Thus, the flue gas flow 17" emitted from the demister 4 includes mist and corrosive substances contained in the mist, such as HF, SO_3, and NO. These corrosive substances heavily corrode any blower or similar devices incorporated in the flue gas flow 17". Moreover, as a consequence of the emission of such mist into the atmosphere, the environment is polluted.

In Lang, the demister 4 and the wet scrubber 2 are integrated in one unit, wherein the separated mist is returned, in a reverse flow, to the wet scrubber 2. Therefore, a storage tank or a discharging outlet such that the present invention defines is not provided. In contrast, the present invention provides a discharging outlet to flow such mist into the storage tank.

JP '455 shows a process of rendering a waste gas harmless before emitting it into the atmosphere, wherein the waste gas, which is generated in treatment of discarded printed circuit boards and includes hydrogen bromide, carbon dioxide and steam, is washed with an aqueous solution of NaOH and then is dehydrated by a cyclone to be dried for emission. JP '455 states that the washed waste gas contains moisture only, inclusion of hydrogen bromide and carbon dioxide is not mentioned.

The cited reference, however, does not mention at all the aspects that not only is NF_3 or SF_6 decomposition-treated, but also that the washing of the gas, which includes decomposition products generated from the decomposition treatment, with water or alkaline aqueous solution causes a part of HF, SO_3, and NO included in the

decomposition products to a form mist accompanied with H_2O. Such mist is emitted into the atmosphere clearing the washing tower. Further there is no description at all about the removal of HF, SO_3 and NO before exhausting into the atmosphere.

JP '455 discloses a gas washing tower 5, the detoxifying of an exhaust gas generated at the gas washing tower 5 through a cyclone type mist separator, and the exhausting of the detoxified exhaust gas. The reference, however, does not indicate the discharging of the mist separated at the mist separating apparatus, or a storage tank at all. The reference does not describe or suggest any concrete structure of the gas washing tower 5 or of the cyclone type mist separator.

In the present invention as stated above, the mist separated at the mist separating apparatus is flowed into the storage tank 18 without passing the gas washing tower 13. The gas exhausted from the gas washing tower 13 is fed to the cyclone mist separating apparatus 21 with corrosive components contained therein reduced. This enables lessening the corrosion in the mist separating apparatus 21 more.

Therefore, the present invention is not such an invention that a person skilled in the art can easily derive from the cited reference, since composition, aim, and effect of the claimed invention are completely different from the cited art.

Kanno '652 describes that decomposition treatment of the PFC gas such as SF_6 and NF_3 produces HF, SO_x (mainly SO_3) and Nox (mainly NO_2), that these decomposition products are made to be absorbed in water or alkaline aqueous solution in the washing tower so that they become washed, and that the washed decomposition products are then emitted into the atmosphere. Kanno '652,

however, does not mention at all such aspects that the washing of the gas, which includes decomposition products generated from the decomposition treatment of NF_3 and SF_6 with water or alkaline aqueous solution causes a part of HF, SO_3, and NO included in said decomposition product to form mist accompanied with H_2O and that such mist is emitted into the atmosphere clearing the washing tower. Further there is no description at all about the removal of HF, SO_3, and NO before exhausting into the atmosphere. Neither does Kanno teach or suggest the steps of discharging of liquid separated by a cyclone mist separating apparatuses to a storage tank.

Finally, Applicants submit that there is no teaching, suggestion or motivation in any of the cited references that would lead a person of ordinary skill in the art to combine their teachings in the manner done so by the Examiner to find the present invention as now claimed obvious.

Moreover, it is difficult to fathom how one skilled in the art would find Applicants' invention obvious when it requires four different references to allegedly arrive at Applicants' invention. To the extent that Applicants' invention allegedly is obvious, it could only be obvious when viewed with the hindsight of Applicants' teachings and would require a total reconstruction of the various cited references to arrive at Applicants' invention. Even if some or all of the elements in Applicants claimed combination may be old elements known in the art, this does not necessarily negate invention. The invention must be looked at as a whole in determining patentability.

It is therefore submitted that the claims as now amended, remaining in the application are patentable.

Conclusion

In view of the foregoing amendments and remarks, the Applicants request reconsideration of the rejection and allowance of the amended claims.

To the extent necessary, Applicants petition for an extension of time under 37 CFR 1.136. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, or credit any overpayment of fees, to the deposit account of Mattingly, Stanger & Malur, P.C., Deposit Account No. 50-1417 (referencing attorney docket no. NIP-198).

Respectfully submitted,

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